

## **SECTION J.3.4**

### **SILO 3 MATERIAL RADIOLOGICAL SAFETY REQUIREMENTS**

#### **J.3.4.1 Preliminary Information**

##### **J.3.4.1.1 Silo 3 Radiological Isotopes of Concern**

From the compiled list of isotopes within Silo 3 (from RI studies), the most limiting isotope (for radiological control purposes) is determined and applied as the isotope of concern. Establishing a radiological isotope of concern identifies what surface contamination and airborne radioactivity limits will be applied for activities within the associated area per FDF's Implementation Plan and RPP for 10 CFR Part 835, Occupational Radiation Protection.

Once work begins that results in potential exposure of personnel to the contents of Silo 3, the isotope of concern will be Thorium-230. In addition to the Th-230 concern with the Silo 3 material, the headspace of Silo 3 contains approximately 300,000 pCi/L of radon (J.2.4.3). Depending on the controls used during retrieval the radon may be an occupational concern.

##### **J.3.4.1.2 FDF-Provided Radiological Control Programs**

FDF will provide the radiological control support required by the DOE-approved RPP. The support will include the technical personnel and instrumentation necessary to provide all phases radiological control field support and will include, but not be limited to:

- The implementation of Radiological Work Permit (RWP) requirements;
- Radiation/contamination monitoring;
- The personnel and area air sampling; and
- The radiological records keeping.

The Contractor shall comply with all radiological control requirements, directions, RWPs, Safe Work Plans, training requirements, sampling, testing, oversight, etc. As part of this, FDF will provide the following:

- DOELAP external dosimetry program (including record keeping and reporting);
- All radiological monitoring equipment;
- Internal Dosimetry program (including air sampling, bioassay, in vivo, analysis, and record keeping);
- Radiological Worker Training program consistent with the requirements of 10 CFR Part 835 and the DOE Radiological Controls Manual; and

- Radiological Control support personnel trained to the requirements of 10 CFR Part 835 and the DOE Radiological Controls Manual.

In estimating the number of radiological control technicians (RCTs) required to support this project the Contractor shall consider the facility design, layout, potential exposure pathways and hours of operation. Also, the Contractor shall consider how the radiological control requirements will be implemented.

#### **J.3.4.2 Premobilization**

##### **J.3.4.2.1 Occupational ALARA Planning and Review**

An Occupational ALARA Plan shall be required at the completion of Process Design (Section C.5.1). The Contractor shall designate a point of contact and provide documentation on the Occupational ALARA Plan as part of the Plant Facility Engineering Package (Section C.5.1.2.1) to be submitted to FDF for technical review and approval. The Occupational ALARA Plan shall identify conditions on the project that require additional engineering controls to control occupational exposure and meet the design criteria specified below:

- Exposure rates are  $<0.5$  mrem in one hour on the average in areas of continuous occupancy (any one worker present 2,000 hours per year) and are ALARA.
- If a worker's occupancy is less than 2,000 hours per year, the individual exposure rate which applies is  $<1,000$  mrem/yr to the whole body TEDE (external plus internal doses) and ALARA.
- Regarding the control of airborne radioactive material and radon gas, the design objective shall be, under normal conditions, to avoid releases to the workplace atmosphere and in any situation, to control the inhalation of such material by workers to levels that are ALARA.
- The design or modification of a facility and the selection of materials shall include features that facilitate operations, maintenance, decontamination, and dismantlement.

Engineering controls to minimize personnel exposure, surface contamination, airborne radioactivity, and the amount of radioactive waste generated shall be incorporated into the project where practical. ALARA principles shall be evaluated using SD-1023, Optimization of Radiation Protection (Attachment J.4.97).

##### **J.3.4.2.2 Health Physics Plan**

A Project-Specific Health Physics Plan (PSHPP) shall be developed by the Contractor to address radiological controls for the Pre-operational, Operational, and Facility Shutdown phases of the project.

The PSHPP shall contain the following elements:

- Radiological Control Limits;
- Exposure limits;
- Radiological Hazards;
- Engineering and administrative controls to mitigate hazards (e.g., ventilation, containment, radiological hold points, etc.); and
- ALARA goals.

FDF will review the status of project ALARA goals on a quarterly basis. If goals are being exceeded, the Contractor shall submit an action plan to FDF detailing how the approved goals will be reached. If the goals continue to be exceeded, FDF reserves the right to dictate changes to the Contractor's safety program. All costs associated with FDF-dictated changes shall be borne by the Contractor.

The PSHPP shall be reviewed and approved by FDF prior to each phase of the project.

#### **J.3.4.2.4 Break Rooms**

The establishment of break rooms in radiologically-controlled areas (where workers may drink beverages) must be approved by FDF Radiological Control. A break room in a radiologically-controlled area is NOT guaranteed under the terms of this contract.

In approved break rooms (in radiologically-controlled areas), workers may drink approved, supplied beverages (in general: soda, water, coffee, and drink mixes). No eating, smoking, or chewing is allowed in the break rooms. If a smoking area is provided at the job site, it will be immediately adjacent to an approved break room, but will be out-of-doors. The only access to the smoking area shall be through the break room. A smoking area in a radiologically-controlled area associated with this project is NOT guaranteed under the terms of this contract.

No anti-C clothing shall be allowed in break rooms with the exception of bagged and laundered anti-Cs that are being returned to the trailers after laundering, which must be moved immediately to the changing areas/locker rooms for storage. The respirator cabinet may be in the break room for accessibility.

#### **J.3.4.2.5 Stop Work Authority**

All FDF and Contractor personnel have the responsibility and authority to stop radiological work when radiological controls are inadequate.

In any situation in which the Stop Work Authority is used, the following requirements apply:

- Exercise the Stop Work Authority in a justifiable and responsible manner;
- Once work is stopped, do NOT resume until proper radiological controls have been established; and
- Resumption of work requires approval of the responsible line manager and the FDF Radiological Control Manager.

### **J.3.4.3 Radiological Limits**

#### **J.3.4.3.1 Contamination Areas**

Contamination areas shall be established when the removable contamination (i.e., radioactive material that can be removed from surfaces by nondestructive means, such as casual contact, wiping, brushing, or washing) levels exceed, or are suspected to exceed, the limits listed below:

- 20 dpm/100 cm<sup>2</sup> alpha contamination for Thorium-230; or
- 1,000 dpm/100 cm<sup>2</sup> alpha contamination for uranium areas.

High Contamination Areas will be established when the contamination levels exceed 100 times the limits for establishing a Contamination Area.

Fixed Contamination Areas will be established when the total contamination (fixed plus removable) levels exceed the levels listed below:

- 500 dpm/100 cm<sup>2</sup> (average per square meter) alpha contamination (for all materials exposed or potentially exposed to Thorium-230 contamination); and/or
- 5,000 dpm/100 cm<sup>2</sup> (average per square meter) alpha contamination (for all materials exposed or potentially exposed to uranium contamination).

For personnel safety, waste minimization, and contamination control purposes, it is recommended that:

- The Contractor limit inspection tours of contamination areas to times when no (or minimal) work activities are being performed; and
- Workers and other personnel minimize the amount/number of equipment and tools brought into thorium contamination areas to reduce the probability of losing

an item that cannot be decontaminated to unrestricted release limits (Section J.3.4.3.1).

Brooms may not be used in Contamination Areas due to the potential for unnecessarily creating airborne radioactivity.

#### **J.3.4.3.1.2 Material Release**

Requirements, including contamination limits for release of Contractor-provided tools, equipment or material from containment or the building enclosure and the Contamination Area or for unrestricted release from the Controlled Area are provided in Section C.7.2.3.7.1.

In order to survey for removable surface contamination limits as low as those for Thorium-230, a low background alpha counter must be used to count disc smears. Devices that can do this on site (Tennelec instruments) generally take two to five minutes to count a single smear and it may take several smears to survey a piece of equipment. Therefore, due to the time involved, it is essential that the Contractor be able to inform the RCTs when items are to be removed from thorium contamination areas.

#### **J.3.4.3.1.3 Release Cleaning of Stabilization Facility**

*Prior to opening a building that stored or processed Silo 3 material to the environment by removing the exterior siding or demolishing a building, the Contractor shall remove and/or fix radiological contamination that exists on the exterior surfaces of process piping, equipment and structures within the facility until the detected levels are below the criteria that follows:*

- !** 20 dpm/100 cm<sup>2</sup> alpha removable contamination;
- !** 100 dpm/100 cm<sup>2</sup> alpha averaged fixed plus removable contamination; and
- !** 300 dpm/100 cm<sup>2</sup> alpha maximum fixed plus removable contamination applied to an area not more than 100 cm<sup>2</sup>.

*The 100 dpm/100 cm<sup>2</sup> alpha fixed plus removable contamination does not apply if a fixative is used to cover the contamination.*

*DDI will survey the facility prior to cleaning to evaluate the need for decontamination of the facility.*

*Contributions to the off-site dose for radionuclides due to facility shutdown and dismantlement activities involving Silo 3 project facilities will be taken into consideration for compliance with the NESHAP Subpart H requirements.*

#### **J.3.4.3.2 Personnel Contamination Monitoring**

Personnel are required to survey upon leaving a Contamination or Controlled Area (including monitoring into the locker room or break area from the Controlled Area), using instrumentation capable of detecting radioactive contamination at the Fixed + Removable limits under laboratory conditions. The following limits shall be applied:

- ! For leaving a Thorium-230 contamination area: 500 dpm/100 cm<sup>2</sup> alpha.
- ! For leaving a uranium contamination area or a controlled area: 5,000 dpm/100 cm<sup>2</sup> alpha.

If a personnel monitoring instrument alarms while a worker is monitoring out of a Contamination or Controlled Area, then the worker shall notify FDF. FDF will determine whether there is a long-lived contamination (e.g., thorium or uranium) on the worker's clothes or skin. If long-lived contamination is confirmed, FDF will begin to document the incident and decontaminate the worker (Section J.3.4.6, Radiological Incidents and Reporting For All Project Work).

#### **J.3.4.3.3 Airborne Radioactivity**

Airborne Radioactivity Areas will be posted around locations that exceed (or have the potential to exceed) a weekly average of ten percent of the DAC limits from 10 CFR Part 835 for the applicable isotope. Engineering and/or administrative controls shall be implemented for these areas to control the impact on personnel and other project areas. The DAC levels that apply to this project include the following:

- DAC for Th-230: 3.0E-12  $\mu$ Ci/ml and shall be applied when working with materials exposed or potentially exposed to Silo 3 material.
- DAC for Uranium: 2.0E-11  $\mu$ Ci/ml and will be applied when working with materials exposed or potentially exposed to uranium contamination.
- DAC for Rn-222 (Radon): 0.333 working levels (WL) one working level equals any combination of short lived radon daughters, in one liter of air without regard to the degree of equilibrium, that will result in the ultimate emission of 1.3E+05 mega electron volt (MeV) of alpha energy.
- DAC for Rn-220 (Thoron): 1.0 WL.

Within the work area, airborne radioactivity shall be controlled to less than 10% of the specific DAC for the isotope-of-concern taking into account the protection factor (PF) of the respirator worn by workers in the area, plus ALARA. The PFs that apply to this project are found in Section J.3.3.2.1.5.

If general area airborne radioactivity exceeds 10 percent of the appropriate DAC (given the appropriate respiratory protection factor), then immediate radiological controls must be implemented at the source of generation to reduce airborne concentration. Upon written notification by FDF, the Contractor has one week to provide FDF with a written explanation of causes and corrective actions that will be taken prevent the recurrence of the situation.

In all cases, the Contractor shall control airborne emissions at the project boundaries such that contributions of all isotopes shall not exceed 2 percent of the DAC-equivalent taken in unison (based on a weekly average).

#### **J.3.4.3.4 Radiation, Dose Limits, and Investigations**

Radiation Areas will be established for any area accessible to individuals in which radiation levels could result in an individual receiving a deep dose equivalent in excess of five mrem in one hour at 30 cm from the source or from any surface that the radiation penetrates.

FDF Radiological Dosimetry performs investigations of unplanned external exposure results when the following limits are exceeded:

- 100 mrem to the whole body; and/or
- 1,000 mrem to the skin, or extremities.

External exposure results are tallied every three months by FDF. If the levels are exceeded, the Contractor shall be required to participate in an investigation into the cause of the exposure. Based on the outcome of the investigation, corrective actions may be required to reduce worker exposure to below these levels. Corrective actions shall be implemented by the Contractor.

Additionally, FDF Dosimetry performs internal dosimetry investigations with possible follow-up bioassay sampling when one of three things occur:

- Air sampling indicates that a worker(s) may have been exposed to levels above the action level for a particular radionuclide.

**NOTE:** Action levels are determined by internal dosimetry on a nuclide-specific basis. Action levels are typically based on a worker's potential to receive two mrem Committed Effective Dose Equivalent (CEDE) in a one week period.

- An incident or routine bioassay sample (urine and/or fecal) result is above the decision level for a particular radionuclide.
- A routine or incident in vivo measurement (i.e., lung) is above the decision level for a particular radionuclide.

When an internal dosimetry investigation is required, actions taken by internal dosimetry are as follows:

- A preliminary internal dose estimate is performed based on air sampling and/or bioassay results;

- An interview is performed with the worker and/or their supervisor to determine radiological working conditions and potential time of intake;
- If preliminary dose estimates are greater than or equal to 100 mrem CEDE, a radiological work restriction is issued and a field investigation is initiated;

**NOTE:** A radiological work restriction may be issued by Dosimetry with approval of the Radiological Control Manager when preliminary dose estimates are less than 100 mrem to limit any further exposure that may prevent obtaining valid follow-up bioassay sampling and interfere with the dose evaluation.

- Obtain follow-up bioassay sampling (in vitro and/or in vivo) to confirm initial results; and

**NOTE:** The type and extent of follow-up bioassay sampling required is determined by internal dosimetry given the type of exposure, the radionuclide, the length of time since the exposure, and the preliminary dose estimate. For incident investigations, involving potential exposure to uranium, a minimum of two samples shall be required.

- Finalize internal dose estimates and notify worker or supervisor after follow-up sampling is completed.

The Contractor shall be responsible for delay costs incurred as a result of any work stoppage caused by the indicated dose assessments, whenever the assessments directly result from error or omission in design or construction by the Contractor, or when they result from a negligent act on the part of the Contractor employees.

Workers shall be restricted from working in radiologically-controlled areas if total (external plus internal) exposures, in any one calendar year, exceed 1,000 mrem TEDE. The following conditions also apply:

- The worker restriction shall last until the end of the calendar year in which the exposure was received; and
- An investigation shall be initiated by FDF when a worker reaches 800 mrem TEDE. The investigation will determine whether the worker requires limitations on work in a radiological area to ensure that the annual limit (1,000 mrem TEDE) is not exceeded.

#### **J.3.4.4 Mobilization and Project Work**

The Contractor shall provide FDF RCTs with at least 24 hour notice, a description of projected activities (including movement of material, release of material, and specific personnel



activities), crew sizes, crew members, and crew locations. This information may be brought directly to the RCT office for the project.

#### **J.3.4.4.1 Minimum Radiological Requirements for Personnel Access and Work Within a Controlled Area or Other Radiological Area**

Contractor personnel requiring access to the Controlled Areas or other radiological areas shall be trained radiological workers meeting requirements of 10 CFR Part 835 and DOE Radiological Controls Manual (approved FDF training programs available). Workers shall participate in FDF DOELAP personnel dosimetry and bioassay programs, and respiratory protection and medical requirements associated with the programs (Section J.3.3).

##### **J.3.4.4.1.1 Project Personnel Radiological Monitoring and Surveillance Requirements**

Project personnel who perform work in a controlled area must participate in the following personnel monitoring and surveillance programs:

- A TLD, issued and maintained by FDF Dosimetry, will be issued to personnel and shall be worn at all times within a controlled or radiological area). A list of personnel must be provided to FDF seven calendar days prior to the need for TLDs. For all new personnel arriving throughout the project, seven calendar days advance notice (Contractor to FDF) is required to acquire a TLD.
- Baseline, annual, incident, and termination urinalysis (controlled and maintained by FDF Dosimetry Section).

Project personnel who perform work in a Radiological Area must participate in the following personnel monitoring and surveillance programs:

- TLD (issued and maintained by site Dosimetry Section; issued to personnel and required to be worn at all times within a controlled area or Radiological Area). For all new personnel to be arriving throughout the project, seven calendar days advance notice (Contractor to FDF) shall be required to acquire a TLD.
- Baseline, routine (every 60 calendar days), incident and termination urinalysis (controlled and maintained by FDF Dosimetry Section). Urinalyses shall be left at the start of the shift on the date required (unless otherwise specified by FDF).
- Baseline, annual, incident, and termination in vivo (controlled and maintained by FDF Dosimetry Section). The Contractor shall notify FDF at least seven calendar days in advance of the need for an in vivo exam.
- Breathing Zone Program: In uranium contamination areas, at least 25 percent of workers per work group/crew (minimum of one worker) wear personal air samplers. All other workers in the work crew shall be signed in on the paperwork

under which their crew-partner received their personal air sampler. Crews that are assigned to work together shall stay in approximation of each other while in the contamination area for which the breathing zone of the workers is being monitored. If this cannot be done, additional personal air samplers shall be issued. In the event of an anomaly (e.g., a failed respirator), all workers may be tracked back to a personal air sampler for data on airborne radioactivity levels in their work area.

- In some areas, a minimum of 25 percent of the workers shall be required to wear a similar-style pump and filter assembly to monitor for radon and thoron. Typically, workers chosen to wear the radon/thoron pumps will wear the same pump for up to a month in order to gain the needed air sample size (controlled and maintained by FDF Radiological Control)

Project personnel who perform work in a Radiological Area controlled to thorium limits, must participate in the following personnel monitoring and surveillance programs (in addition to those listed above):

- Upon request by FDF, a Contractor employee must provide FDF with a fecal sample. Typically, samples are required following an incident in which thorium may have been ingested or inhaled by a worker. As well, baseline fecal samples are required of workers that are new to the site and who have worked with thorium or in a thorium-contaminated area previously.
- The Contractor shall ensure that employees that have worked with thorium, or in a thorium-contaminated area previously, are identified to FDF.
- A worker may NOT work with thorium or in a thorium-contaminated area until baseline samples, as required, and/or further samples, as requested, have been left per these instructions.
- Breathing Zone Monitoring Program: In Thorium Contamination Areas, 100 percent of workers wear FDF-supplied, belt-mounted lapel personal air sampler pumps with tygon tubing that runs up to a filter cartridge (with filter) clipped on to the lapel (this is called a personal air sampler (PAS)).

#### **J.3.4.4.2 Work Permits, Radiological Work Permits and Safe Work Plans**

Upon receiving the Authorization to Mobilize, the Contractor shall obtain the appropriate work permits to begin work. Every activity performed by the Contractor must be covered by a work permit or an approved Safe Work Plan. Attachment J.4.49 addresses developing Safe Work Plans.

The FDF facility owner will assist the Contractor in initiating work permits with the appropriate information, such as job location and detailed job description. The job description must be specific enough to allow H&S personnel to evaluate and assign proper controls for the job.

When a job description is deemed too broad by FDF H&S, the permit initiator shall fill out a new, more specific job description. From this work permit, all necessary safety permits may be generated.

RWPS will be generated by FDF. One RWP will be generated for each Safe Work Plan and one for each Work Permit. Work may not begin until the appropriate RWP is in place for certain activities at FEMP that include, but are not limited to:

- Entry into any radiological area as defined in 10 CFR Part 835;
- Breaching any process line, tank, vessel, or enclosure containing radioactive material that may become loose or airborne during the work;
- Any work within the controlled area or on contaminated or potentially contaminated equipment where safety precautions are not adequately discussed in technical work documents approved by Radiological Control;
- Decontamination of highly contaminated equipment;
- Digging or disturbing soil in a Soil Contamination Area; and
- Breaking the barrier of a Fixed Contamination Area.

For the purposes of this project, the RWP may refer directly back to a Safe Work Plan for controls (engineering, administrative, and PPE) and all other radiological considerations. If the RWP was generated for a Work Permit, all radiological controls will be included in the RWP. The H&S Plan and supporting procedures shall provide equivalent information covering operations and maintenance.

Workers shall be briefed on the contents of each RWP and Safe Work Plan under which that worker will perform work and the conditions of the work area. Workers shall sign the acknowledgment sheet one time (per revision to the RWP or Safe Work Plan) to indicate an understanding of the requirements of that RWP or Safe Work Plan.

Prior to entering the work areas, workers shall sign the daily sign-in sheet on the RWP applicable to the work they are going to perform and shall sign out upon exiting these areas. Workers sign in for tracking purposes and may only be signed-in on one RWP/daily sign-in sheet at a time.

The Contractor shall provide a permit board/posting area for items (e.g., General Work Permit, Radiological Work Permit, H&S Plans).

#### **J.3.4.4.3 Radiological Area Control Points and Access Control**

All control points/radiological area boundaries (with step-off pads) within the work area, beyond the control point trailers, shall be enclosed and of sufficient size (shed, containment, etc.) to contain and cover those necessary materials and equipment to monitor personnel, personal items, or equipment (when necessary), collection of any PPE that may be donned or doffed at this point, etc. A control points shall be established for all radiological area boundaries.

#### **J.3.4.4.3.1 Access to the Controlled Area**

The workers shall obtain their TLD prior to reaching the Controlled Area. TLDs shall be worn while the worker is in the Controlled Area and shall be stored on the storage rack assigned to them when not in this area. TLDs shall be worn on the outside of the worker's clothing (non-PPE), facing forward, between their waist and shoulders. The following requirements apply to badging in at the Access Control Point:

- At the control point (access way from the uncontrolled area to the controlled area), workers shall bar code into the computer verifying their training and bioassay requirements are current. If the access control computer system is inoperable, training shall be verified by visual inspection of the worker's qualification card; and
- If a worker's training or bioassay is insufficient or out of date, access to the controlled area shall be denied.

#### **J.3.4.4.3.2 Access to Change Trailer**

Personnel and material monitoring shall be required prior to entry into the project break room or locker room if coming from a Radiologically Controlled Area.

#### **J.3.4.4.3.3 Access to the Contamination Area**

The following are standard requirements for access to the Contamination Area:

- Workers shall sign the appropriate RWP for entry into the work area, collect prescribed respiratory protection, enter their badge number and respirator serial number into the project control point computer logging system, show evidence of being respirator fit to the control point RCT, go to the dressing area, and don the prescribed protective clothing;
- If a worker's training or bioassay is insufficient or out of date, access to the Contamination Area shall be denied;
- When wearing protective clothing such that no skin is exposed (e.g., full anti-Cs and a respirator), the worker's TLD must be worn underneath the protective clothing. When protective clothing requirements are such that skin is exposed (e.g., no respirator), the TLD must be worn on the outside of the anti-C clothing;

- Prior to entering the work area, workers must contact an RCT for assignment to a personal air sampler and testing of the airflow of powered air purifying respirators (if worn). The following conditions apply to wearers of personal air samplers:
  - When changing work areas, the worker shall sign in on the appropriate RWP and verify their level of PPE is in compliance with the RWP. If the worker must change protective clothing prior to moving to a new job area, the worker shall exit the Contamination Area and go through the appropriate steps for reentry, wearing the correct protective clothing. The worker shall be reassigned to a different personal air sampler; and
  - In areas where thorium is the isotope of concern, 100 percent of the workers will be required to wear personal air samplers.
- Where thorium is the radionuclide of concern, the Contractor shall anticipate that anti-C clothing and PPE requirements will include powered air-purifying respirators, and double anti-Cs (with the outer layer being consumable and the inner layer being launderable or consumable unless otherwise prescribed by the applicable radiological work permit); and
- Personnel entry into the Contamination Area shall be through the established control point.

#### **J.3.4.4.3.4 Exiting the Contamination Area**

Workers shall leave the work area and doff anti-C clothing at the appropriate control point whenever their protective clothing is compromised or when, nonwater-resistant anti-Cs get wet or workers sweat through their protective clothing. FDF will periodically monitor contamination levels on outside of anti-Cs. If contamination, as detected by a RCT, on the outside of a worker's work gloves is found to be greater than 1,000 counts per minute, the worker must change their work gloves. If this level of contamination is found on the outside of a single layer of anti-C clothing, workers shall return to the control point to change their protective clothing.

It is estimated that a minimum of four workers per day shall be sent through this routine. If ten percent of the Contractor work force is greater than four workers, estimate that ten percent of the workers shall be sent through this routine daily.

The Contractor shall recognize and allow additional time for monitoring when exiting thorium contamination areas due to the lower contamination limits. Workers in Thorium Contamination Areas or High Contamination Areas that are in Contamination Areas shall always be in a double layer of anti-C clothing. Prior to leaving any of these areas, workers shall doff their outer set of anti-Cs at the work area boundary and proceed directly to the appropriate change out facility. Doffing of the inner layer of anti-Cs, and personnel monitoring with a PCM, shall be performed at the change facility.

Personal items may be surveyed out by the workers themselves (except from areas controlled to thorium limits), using friskers provided at the control point.

Tools, lapel samplers, and equipment (and, in the case of Thorium Contamination Areas: personal items) may only be surveyed out of a Contamination Area by an RCT. Workers requiring items of this nature to be removed from the Contamination Area must give the RCT notice of such a need at least one full work shift in advance (Section J.3.4.3.1.2).

Whole body personnel monitoring shall be required prior to exit from contamination areas.

Workers shall sign out on the RWP upon exiting and badge out.

#### **J.3.4.4.3.5 Exiting Controlled Areas**

After exiting the Contamination Area, to gain access to the clean area of the site (i.e., to exit the Controlled Area), workers shall monitor through a PCM. All material exiting the Controlled Area shall be surveyed.

After successfully monitoring through the PCM, the workers shall then place their TLD in the appropriate slot of the TLD storage rack (slots are labeled with badge numbers).

#### **J.3.4.4.4 Anti-C Clothing, PPE, and Contractor-Issued Clothing**

Anti-C clothing shall not be worn in Controlled Areas unless worker is donning anti-Cs for entry through a control point into Contamination or Airborne Radioactivity Areas.

Each individual required to wear anti-C garments shall inspect them for tears, holes, split seams, missing buttons or zipper damage prior to use and shall replace defective items with intact anti-C clothing.

**NOTE:** For the purposes of waste minimization, the Contractor is encouraged to use launderable anti-C clothing as an inner layer of anti-Cs where double layers are required. However, double anti-Cs may be two layers of disposable anti-Cs.

Anti-Cs are regularly removed and discarded after one use (i.e., whenever a worker exits a contamination area). In the case of disposable anti-Cs, they go into the trash/waste stream. Launderable anti-Cs shall be segregated and returned to laundry services. Each individual required to wear anti-C garments shall don and doff these garments as taught in Radiological Worker Training. If anti-C coveralls are required, all interfaces or potential openings at the ankles, wrists, and (if a hood is required) the neck area, shall be covered, secured, or taped.

Outside of taking emergency action, no action may be taken in contamination areas which will expose any area of a worker's body or clothing, protected by anti-C clothing or other PPE other than the act of doffing anti-Cs at the control point with the intention of leaving the

contamination areas. The only other exception to this is the removal of respirators in a Heat Stress Control Room set up in uranium contamination areas only.

When the Contractor has construction areas within a Contamination Area, the Contractor shall maintain a set of hard hats designated to only be worn in contamination areas. Likewise, any protective clothing that goes on the outside of typical anti-Cs (i.e., doesn't come into contact with workers' skin or hair), like hip boots, is allowed and encouraged to be kept in the contamination area at the control point where workers enter and exit this area. These may be the last items the workers don prior to going to work.

The following five types of anti-C garments could be specified for likely work conditions at the FEMP.

- **Lightweight, disposable:** barrier to particulates (radiological and other), asbestos, and lead. This is a breathable-type garment that aids in the evaporation of perspiration. Lightweight disposables **shall not be worn as an outer layer** for protection from liquids or chemical hazards, or when wet conditions can be expected.
- **Waterproof, disposable:** used as a barrier for casual or indiscriminate contact with water or liquids (i.e., mist from spray, wet surfaces, dew). The waterproof coverall has design specifications for breathability which minimizes heat stress concerns when waterproof protection is required. This waterproof coverall shall not be used when repeated or prolonged contact with water is expected. Disposable "rain suits" and Saranex® aprons are other types of waterproof disposables that shall be required for specific situations requiring proximity protection.
- **Chemical protective, disposable, or reusable:** used as barrier to liquids, particulates, and specified chemicals. This type of anti-C shall be used for extremely wet conditions when repeated or prolonged contact with liquids can be expected, for protection from specified chemicals, and for specific cases when a durable outer layer of protection is necessary.

**NOTE:** Radio belts or other objects worn on the outside of Saranex®-coated Tyvek chemical protective coveralls can degrade or "strip" the Saranex® coating from the Tyvek base. This could result in a personnel contamination incident if an individual has repeated or prolonged contact with radioactively-contaminated liquids, or it could result in exposures to certain chemical hazards. Care shall be taken to avoid these situations by placing radio belts (or other) as to avoid direct friction with the Saranex® coating. If the object can be worn on the inside of the garment, this would be preferred. If it cannot, the worker could place a barrier (duct tape or other appropriate material) between the object and the outer surface of the Saranex® garment.

Rubber shoe covers worn directly over Saranex® booties have had the same effect. RWPS and Safe Work Plans must account for this whenever Saranex coveralls are required and contact with liquids in the foot area is possible. One acceptable method is to wear waterproof booties (PVC, other polymerized or rubber, or 200 Denier coated nylons) under the attached Saranex® bootie; the Saranex® bootie would then be covered with a rubber shoe cover. This will prevent the foot area from getting contaminated if the Tyvek base is exposed.

- **Fire retardant, launderable or disposable:** used as protection when performing "hot work." The launderable types are normally constructed of Nomex (or other materials approved by FDF Fire Protection Engineering). Select disposables for "hot work" will be approved on a case-by-case basis by FDF. Inner waterproof or chemical protection may be required on a case-by-case basis when other workplace hazards are present.
- **Other launderable types:** used as a barrier to particulate forms of radiological contamination. They are constructed with cotton, cotton/polyester blends, or nylon fabrics. Depending on the garment type, it may be a durable rubberized material. Cotton, cotton/polyester-blend, or nylon fabric types shall not be used as an outer or single layer of protection from liquids or chemical hazards, or when wet conditions can be expected. Cotton, cotton/polyester-blend, or nylon fabric types shall not be worn as a single layer of protection for heavy work activities which require repeated, prolonged, or continuous contact with contaminated surfaces.

The specified glove types for radiological work are nitrile or neoprene. Cotton inserts can be worn with these glove types, but for comfort purposes only. Other types of gloves may be specified by IH for physical hand protection and for protection from specified chemicals. All gloves used in Contamination Areas must be disposed of in appropriate waste containers and shall not be permitted to leave areas posted for contamination.

A typical set of full anti-Cs consist of coveralls, gloves, booties, rubber overshoes, and a hood or skullcap. Additional anti-C requirements (extra set of gloves, booties, etc.) may be required for certain situations; these requirements will be specified on the PPE page of the FDF Work Permit or in the Contractor's Safe Work Plan.

Final anti-C requirements for a particular job or task will be determined in the Work Permits or Safe Work Plan process. Limiting radiological conditions will be placed in the Work Permits or Safe Work Plan for the anti-C requirements that have been specified. Anti-C requirements shall be determined by existing conditions and scope of work.

With the exception of rubber shoe covers and launderable welder coveralls, launderable anti-Cs shall not be worn as outer layer of protection in Contamination, High Contamination, or Airborne Radioactivity Areas that are controlled for isotopes other than uranium (i.e., thorium, radium, or other).



Rubber overshoes: RCTs providing coverage to project areas that are controlled for isotopes other than uranium (i.e., thorium, radium, or other) shall survey these for release from those areas. Otherwise the overshoes should be discarded as low-level radioactive waste unless an alternative method of reuse is approved by FDF Radiological Engineering.

#### **J.3.4.4.4.1 "Hot Work" Activities**

When launderable welder (fire retardant) anti-C garments are worn as an outer layer of protection in areas that are controlled for isotopes other than uranium (i.e., thorium, radium, or other) they shall be surveyed for free release from those areas. The RCT performing this survey will use a tape press on items found to be contaminated, but only if the contamination is dry and the surface area contaminated makes this feasible, otherwise discard the garment as radioactive waste.

Any individual performing welding or burning activities ("hot work") in Contamination, High Contamination, or Airborne Radioactivity Areas is required to wear the orange flame retardant coveralls. This color designation has been approved for flame retardant anti-C garments only.

Orange welder coveralls shall be worn in areas controlled for contamination or airborne radioactivity and are not permitted for use in any other area. Green is the color of welder coveralls when anti-C clothing is not required.

When double sets of anti-C clothing are required, welder coveralls shall serve as the outer layer of protection. Any other type of anti-C protection can be worn under the welder coveralls.

Consult FDF Radiological Engineering and Fire Safety for each case involving hot work. Additional protective garments will be required, depending on the situation and shall be specified in the FDF Work Permit or the Contractor's Safe Work Plan.

#### **J.3.4.4.4.2 Special Considerations**

Wearing knee high overboots or waders shall be considered for muddy, contaminated areas or contaminated areas where liquids have accumulated. Appropriate doffing and reuse requirements for these garments must be established on a case-by-case basis. Disposable PVC or rubberized booties which extend above the ankles may be appropriate. This shall be evaluated on a case-by-case basis under the FDF Work Permit System or the Contractor's Safe Work Plan.

A face shield and waterproof hood is required when a reasonable potential exists for liquids to splash in the facial and head area. If a full-face respirator is being worn, the face shield is not required.

Chemical protective (Saranex®) anti-C clothing shall be required if the potential exists for contact with contaminated grease, oil, or other similar types of surface contamination.

Chemical protective (Saranex®) type anti-Cs shall be required for some radiological/chemical hazards.

Chemical protective (Saranex®) type anti-Cs shall be required as an outer layer when more than casual or indiscriminate contact with radiological liquids is likely. For example, when there is a continuous exposure to pressurized wash overspray or when in direct path of a continuous stream of liquid.

When double anti-Cs are required and water-proof (or Saranex® type) anti-Cs are necessary for a particular job, any type of anti-C garment can be worn as the inner layer of protection.

In areas where separate men and women change facilities exist, the PPE page of the work permit or the Contractor's Safe Work Plan, shall specify: "when launderable anti-Cs are worn as the first layer, only underwear shall be worn under this garment to minimize heat stress potential." In areas where adequate change facilities are not provided, the use of modesty clothing will be considered. The allowance for underwear to be worn under disposables will be evaluated on a case-by-case basis under the FDF Work Permit system.

If perspiration is penetrating the outermost layer of anti-Cs and there is an indication that the protective properties of the garment are deficient for the nature of the work being performed, affected individuals shall proceed to the control point to doff all layers of their anti-C clothing, monitor, and exit the affected area. The individual can reenter the area after putting on a new set(s) of anti-Cs. During high heat periods, individuals may require multiple change-outs.

The use of disposable "particulate only" (paper) anti-C coveralls (as a single layer of protection) shall not be allowed, unless specifically approved by FDF Safety and Health.

Gloves that are specified for physical hand protection from sharp or rough work surfaces or are specified when abrasion resistance is needed, shall be worn in addition to the specified layers of anti-C hand protection.

Areas located below unprotected (or open) overhead work must be posted with barrier rope or tape and appropriate restrictions must be placed on personnel access. A hard hat and the same level of anti-C protection (as workers above) is required.

Any work which requires close proximity to overhead structures or has the potential to create falling debris shall require a hood in place of a skullcap.

Cold weather gear (coats, jackets, etc.) shall be worn under anti-C clothing, unless the gear is an approved anti-C garment.

Cotton glove liners may be worn inside standard gloves for comfort, but shall not be worn alone or considered a layer of protection.

Lessons learned from of a particular job or work evolution may be indicative of anti-C failure. If this is the case, consideration of more durable anti-Cs or other engineering controls shall be made by the Contractor.

Hard hats may be worn either over or under anti-C hoods. The decision to wear the hard hat over or under the hood shall be made by considering these two situations:

- If wearing the hard hat under the hood interferes with the seal of respiratory protection or interferes with the ability to cover/seal the interface of the hood to the respiratory protection facepiece, the hard hat shall be worn over the hood.
- A hard hat can be worn under an anti-C hood only if it is treated like a personal garment and surveyed for unrestricted free release each time the individual doffs for exit from an area. That means that the hard hat must be completely covered by the hood and the hood interfaces are appropriately secured.

If a hard hat storage area has not been established within a posted radiologically-controlled area, hard hats shall be doffed (at the control point step-off pad) by individuals exiting these areas. The individual shall turn the hard hat over to a RCT for survey and release.

Storage of hard hats in posted Contamination Areas is allowed if the hard hat is worn over the hood. The hard hats shall be periodically monitored by the project/area coverage technicians.

Personal head gear (i.e., scarfs, kerchiefs, baseball caps, etc.) must be maintained so that no part of the head gear comes in contact with the exterior surfaces of anti-C clothing.

**NOTE:** When a hood or skullcap is required, the affected piece of personal head gear must be completely covered.

Personal head gear that cannot be covered by an anti-C hood or skullcap shall be removed prior to entering a Contamination or Airborne Radioactivity Area.

Long hair which extends below the collar of anti-C clothing shall be maintained or covered by anti-C protection.

#### **J.3.4.4.5 Work Area Boundaries**

The Contractor shall establish the project boundaries. The Contractor shall submit the proposed radiological boundaries for review by FDF.

The Contractor shall install and maintain yellow snow fence (Section C.5.2.1.4) to outline the radiological work areas, if physical boundaries do not exist. The fenceline must surround all contamination areas and areas with the potential to be contamination areas. In situations where chain-link fence and yellow snow fence requirements overlap, the chain-link fence is

required and will be posted by FDF RCTs. Yellow snow fencing shall not be used to define the boundary between Controlled Area and uncontrolled areas.

At the time when any physical boundary which served as a boundary to a contamination area is removed, it shall be replaced with the yellow snow fence.

All areas encompassed within the yellow fenced boundary will be considered a radiological contamination area and will be posted (yellow-and-magenta or yellow-and-black signs indicating such things as the isotope of concern, whether an RWP is required to enter, etc.) by FDF Radiological Control. The radiological access control point will be located at the boundary of the area and will serve as the normal access/egress point to the contamination area.

For outdoor work, High Contamination Areas within contamination areas, must also be defined by yellow snow fencing. FDF RCTs will be responsible for the signs that label the areas. The Contractor shall be responsible for the fencing itself. The Contractor may elect to have areas defined above the necessary level (e.g., as a High Contamination Area when only a contamination area is required) in order to improve logistics on the project.

Any boundary that separates contamination areas of differing isotopes (e.g., a uranium contamination area and a Thorium Contamination Area) must also be separated by yellow fencing. Survey requirements and anti-contamination clothing changes (e.g., removal of an outer set of anti-Cs when going from the Thorium Contamination Area to the uranium area) shall be required.

#### **J.3.4.5 Demobilization**

The Contractor should assume that extensive dismantlement and an aggressive decontamination effort shall be required to achieve unrestricted free-release of items which have come in contact with waste associated with this project. Based on past experience using BAT, decontamination to free-release limits is difficult to achieve. Contractors are encouraged to evaluate (by cost-benefit analysis) whether those items that the Contractor wants to free-release are worth the dismantlement and decontamination efforts required.

The Contractor shall evaluate tools and equipment for ease of dismantlement and decontamination prior to use on-site. If free-release of items is planned, appropriate precautions to prevent contamination shall be implemented prior to and during use.

The Contractor shall comply with all applicable contamination limits, rules, standards, and regulations in force at the time of any release activities.

##### **J.3.4.5.1 Release of Equipment, Materials, and Office and Storage Trailers**

At the close of the project, all equipment, tools, vehicles, buildings, etc. in the Thorium Contamination Area will be suspected of being contaminated with thorium. Items to be

disposed of as waste may be handled per the specifications in Section C.5.1.1.3.3 of this contract.

It is anticipated that the Contractor will require vehicles to cross the OU2 haul road. The Contractor can assume the radiological survey will take approximately ten minutes to complete.

The specific requirements for decontamination and the unrestricted release of Contractor tools and equipment can be found in Section C.7.2.3.

#### **J.3.4.6 Radiological Incidents and Reporting For All Project Work**

##### **J.3.4.6.1 Radiological Incidents**

The Contractor shall perform necessary actions to maintain occupational exposures below those limits presented in this contract (internal and external exposures) and is to practice ALARA at all times. The Contractor shall maintain airborne emissions and contamination levels within the limits required in this contract with the proper use of engineering and administrative controls. Air emissions and contamination levels will be measured by FDF and reported to the Contractor within 48 hours of completing the analysis or immediately upon determining a problem may exist. All radiological incidents shall be reported to FDF Radiological Control. Examples of incidents include, but are not limited to skin or clothing (non-PPE) contamination, situations where radioactive material uptake is suspected, and situations where contamination is spread to a controlled area or clean area.

FDF is a DOE PAAA-indemnified Contractor, and all Contractors working for FDF are subject to laws related to DOE PAAA-indemnified Contractors spelled out in 10 CFR Part 820, Procedural Rules for DOE Nuclear Activities.

##### **J.3.4.6.2 Reporting and Classification**

Pursuant to various requirements set forth in DOE Orders, notices, and regulations and those listed in FDF manuals, policies, and procedures, it is the responsibility of all site personnel to report any abnormal event (procedure violation, personal contamination, explosion, etc.), condition, occurrence, accident, illness, or emergency to their supervisor/team leader. It is the responsibility of the Contractor's supervisor/team leader to report the event to the AEDO or to the Communication Center as soon as possible. The Contractor's supervisor/team leader is also required to make a daily log entry about the event or condition. This entry should include enough information to reconstruct the event and its associated consequences and corrective and recovery actions plus the estimated dollar amounts of damage to property or cost of the corrective actions taken. A copy of this entry shall be forwarded to FDF within 24 hours.

Once an event has been reported to the AEDO, the AEDO and the EDO will categorize the event in accordance with DOE Order 232.1, Occurrence Reporting And Processing of Operations Information. In the case of a Off-Normal event or higher, a critique of the event must be conducted within three working hours. The Contractor's supervisor/team leader of the

area will be responsible for ensuring that all applicable workers attend the critique. In some cases, critiques may be conducted for events categorized at a reporting level below Off-Normal status, at the discretion of the AEDO and/or the EDO.

Based on the facts of the event determined at the critique, the FDF Occurrence Reporting Team (ORT) will prepare and submit to DOE (within six working hours of categorization of the event) a Fact Sheet for accuracy before submittal to DOE. The FDF ORT will then prepare and submit a Notification Report for the event on the Occurrence Reporting and Processing System. This is a computerized database of all events throughout the DOE complex and is based in Idaho.

The Project Team responsible for follow-up actions related to the event will then be assigned responsibility for closing out the Occurrence Report. This will include entries in the report describing a root cause determination, corrective actions, evaluations as to the significance of the event, and lessons learned. These items must be submitted to the ORT for formatting within 35 calendar days after the categorization of the event.

#### **J.3.4.6.3 Radiological Deficiency Reporting and Related Disciplinary Action Process**

A Radiological Deficiency Report (RDR) will be written by FDF to document radiological deficiencies, including, but not limited to the following:

- Radiation exposure exceeding site administrative levels;
- Unplanned exposures to airborne radioactivity or high radiation fields;
- Violation of posted requirements;
- Improper or unauthorized use of protective clothing or equipment;
- Inadequate radiological monitoring when going from an area of higher radiological control to an area of lower radiological control;
- Eating, drinking, smoking, or chewing in prohibited areas;
- Deviation from procedures which could result in increased exposure to radiation or the spread of radioactive contamination;
- Improperly controlled radioactive materials in non-radiologically controlled areas;  
or
- Observation of poor performance of accepted health physics practices.

The Contractor's supervisor/team leader responsible for correcting deficiencies or the Contractor's supervisor/team leader of the responsible individual (whichever applies) shall,

within three working days of receipt of the RDR (with Severity Level filled in), complete the written response section of the RDR (Section 3), summarizing action(s) taken and/or planned and forward the RDR to FDF for inclusion in, and closing out of, the original RDR file.

The disciplinary action applied, guided by the Severity Level assigned on the RDR, shall be consistent with the FDF Rules of Conduct (Attachment J.4.27, FDF HR Procedure No. 145 Employee Discipline) and coordinated through FDF IR.

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